For the truth of history it should be stated once for all that many investigations on this subject had been under way for years before Koch's announcement. At the laboratory of the State Live Stock Sanitary Board of Pennsylvania studies had been going on for three years previous to this, and at the Congress where Koch made his announcement a paper was read giving the results of these investigations, which to a large extent disproved the assertions of Koch. In 1902 the work from this same laboratory gave the final proof of Koch's fallacies. It is curious that the author of this book should have entirely omitted all mention of this work which has been widely published and certainly is easy of access.

The list of references is made up almost entirely of bulletins from State Agricultural Experiment Stations and the Bureau of Animal Industry, and no general list of useful papers on this subject is given. Among the references, Bulletin No. 75, Pennsylvania Department of Agriculture, 1901, is credited entirely to Pearson. It was a conjoint publication by Pearson and Ravenel.

The book lacks sequence. For instance, under "Method of Dissemination" in a summary by Peterson "on the finding of tubercle bacteria in the milk and excreta," on page 34, we find Abbott and Gildersleeve quoted on the relation between tubercle bacilli and other members of the acid-fast group.

Although Bulletin No. 75, Pennsylvania Department of Agriculture, is given as a reference, it is evident that the author gave as little attention to the contents as he did to the title. In the summary concerning the finding of tubercle germs in milk, which he quotes, he has entirely omitted the work given in that bulletin. This was quite an extensive piece of work, done with unusual care, and was among the first carried out in the United States on this point.

In a subsection on "Channels of Infection" we find the buying in of diseased cattle and infection through creamery and cheese factory by-products given—certainly not channels of infection.

The best chapter in the book, exclusive of the report of the International Commission on Bovine Tuberculosis, is that on Tuberculin, which occupies nine pages.

These criticisms will show that the book is not one that can be recommended, and it should not be dignified with the title which it carries. It might pass as an experiment station bulletin, but nothing more. It is to be regretted that the "cacoethes scribendi" will run away with the judgment of good men, and lead to the publishing of such a book as this.

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Catalogue of the Lepidoptera Phalænæ in the British Museum. Vol. XII. By Sir George F. Hampson, Bart. London. 1913. Pp. xiii + 626.

This volume contains the continuation of the family Noctuidæ, already partly treated in Volumes IV. to XI. of these catalogues. A part of the subfamily Catocalinæ is covered. A key to the genera is given, which will be reprinted in a more complete form in the next volume. Sixty-three genera with 643 species are fully described and a large proportion figured in colors in the accompanying book of plates, numbered CXCII. to CCXXI. The definition of the group, based on the presence of spines on the mid-tibiæ is somewhat artificial, as the author admits, but will probably not cause confusion in many cases. Otherwise it would be necessary to include this group in the already large subfamily Noctuinæ. The treatment is similar to that already familiar to us in the preceding volumes and is a welcome addition to this indispensable work.

Harrison G. Dyar

SPECIAL ARTICLES

SOME EFFECTS OF THE DROUGHT UPON VEGETATION

The summer of 1913 was exceedingly dry and hot in many parts of the United States, but the combination of climatic and edaphic factors which produce that complex effect included under the term *drought* appeared to center in southeastern Nebraska, eastern Kansas, northwestern Missouri and southeastern Iowa. Lines of extremely xerophilous condi-

tions radiated from this general axis for several hundred miles in nearly all directions.

During this period there were a number of days when Lincoln, Nebraska, experienced the highest temperature recorded by the eighty or more stations of the U. S. Weather Bureau which report to the Lincoln office. The dry period began at Lincoln on June 8 and continued until about September 8. According to the director of the Lincoln section of the Weather Bureau only 2.84 inches of precipitation was recorded for this period. This represents but twenty-five per cent. of the normal rainfall for this time at this station. Almost one half of this amount fell in such small quantities as to be of little benefit to vegetation. Weather records have been kept at Lincoln for thirty-two years and this is the lightest rainfall ever recorded for ninety-two days at this time of year. The normal precipitation for this period is 11.33 inches.

The temperature was high for the last part of June and the first half of July, but the first of the higher temperatures were recorded between July 13 and 17. These five days were very hot, the maximum temperature ranging from 102° F. to 109° F. More moderate temperature followed these first blistering days for about one week and then the remarkable hot period began. High temperatures prevailed with hardly a break from July 26 to September 7 or 8. During these forty-four days there were twenty-three days when the maximum temperature was 100° F. or more and it was below 90° F. on only seven days. On an additional number of these days the temperature went to 97° to 99° F. During the whole period from June 8 to September 8 there were twenty-nine days with a temperature of 100° F. or higher.

The relative humidity was low at various times during this long-continued "hot wave" and the conditions favoring desiccation were accordingly greatly magnified. Add to all these rigorous climatic conditions the influence of a strong wind which prevailed at times during the heated season and this region was at the mercy of the most extremely dry and protracted summer weather on record.

The most important effect of the drought is reflected in the greatly reduced yield of a number of the leading field, forage and garden crops, the products for which the territory is renowned. Fortunately the yield of winter wheat was not seriously impaired because that grain was so far advanced toward maturity at the beginning of droughty conditions that there was plenty of moisture in the soil (from a very promising spring) to satisfy the needs of that particular crop. In fact it appears that the yield of winter wheat for the year 1913 was considerably in excess of the average for practically all of the drought-stricken territory west of the Mississippi.

The second and third cuttings of alfalfa were, however, much less than normal for the region as a whole. Some farmers secured a very low return from the third crop of this legume. The yield of potatoes and other less important garden vegetables was also greatly affected by the hot dry days of the latter part of the vegetative season, although in certain parts of the region potatoes are yielding heavily.

Corn was the crop which suffered most, and, since the prosperity of the country is so often figured with reference to the yield of this crop, the effects of the drought appear unusually severe. Except in a few portions of this state (Nebraska) the yield of "King Corn" was very greatly diminished and in some parts, where at least *some* corn usually grows, absolutely no corn will be harvested.

One of the most noticeable effects of the drought upon the native plant life was seen in the shortening of the period of vegetative growth and in the hastening of flowering and fructification. This was noted especially with various herbaceous plants which apparently completed their summer activities several days or weeks earlier than usual. Early leaf maturity and leaf fall was common among native and exotic forest trees. In some cases almost all of the leaves had fallen by the end of July, while in nearly all of our trees noticeable early leaf fall was characteristic. Trees especially conspicuous in this regard in Lincoln were the

hackberry, *Celtis occidentalis;* elm, *Ulmus americana;* and Carolina poplar, *Populus.* These trees also showed great variations in the condition of their leaves, some individuals being nearly leafless at the same time (August) that others were quite normal. Many gradations occurred between these two extremes. The ash, *Fraxinus lanceolata,* was apparently affected to the least degree of all of our commoner tree species. Street trees in general suffered greatly and many such individuals perished during the summer. One man, the owner of a very attractive home and grounds in another city of the state, told me that he had kept three lines of hose constantly pouring water into the ground about his trees throughout the summer and that even then some of the trees were affected by the dry weather.

Toward the close of the summer it was noted that a number of the trees that had lost practically all of their earlier leaves had developed many new bright green leaves, which, however, were much smaller than the typical leaves of the species. The most conspicuous examples of this phenomenon occurred in the hackberry and in the Kentucky coffee tree, *Gymnocladus dioica.* Some trees of the former species put forth practically a full number of new leaves, but the small size of the late leaves made such trees rather noticeable. Many clusters of short compound leaves with very small leaflets appeared upon the almost bare, club-like branches of the coffee tree. In this case the new leaves came from dormant buds situated at some distance below the shoot apices.

Native woods along the streams of the eastern part of Nebraska were unusually dry and barren. The usual mesophytic undergrowth was greatly reduced in volume and few species of the usual summer and early autumn fungi were to be seen. The rich soil of the more open parts of such woods became as dry and powdery as that of the fields and some of the moisture-demanding plants of such habitats dried up and disappeared long before the usual time. Many of the spring-fed streams of the woodlands disappeared completely and the ravines became desiccated to a very unusual degree.

Native pastures suffered greatly and after July 15 little or nothing of forage value was to be found in such places. The ground became very dry and in some places broke into great blocks of extremely hard soil with prominent fissures between the solid masses.

The dryness of native vegetation and fields along the railroads resulted in the starting of an unusual number of fires by sparks from passing locomotives. Such blazes destroyed considerable grain in the shock or stack and in at least one case resulted in the death of a farmer and several of his horses. During a trip across the state early in September it was noted that many fires had been kindled in this manner so that the railroad right-of-way and sometimes for considerable distances on either side the grass or stubble had been destroyed by fire for long distances. Groves of planted trees or rows of trees along the railroad were frequently damaged or completely killed. This indirect effect of the drought seemed to be unusually common in many parts of the drought-stricken territory.

As cooler and moister weather succeeded the trying drought numerous cases of renewed activity on the part of vegetation were evidenced. The most pronounced late season reaction of this sort was observed in the re-greening of lawns, pastures and roadsides which had appeared as areas of stubble for so many weeks. The fresh green of early October is most welcome evidence of the fact that vegetation was not entirely burned out under the protracted desiccation of the long summer weeks.

Examples of the autumnal flowering of trees have been noted in greater than usual number. That this phenomenon is not induced in all cases by the succession of moist weather after a period of drought (as is commonly supposed) is shown in the case of a cherry tree on the campus of the University of Nebraska. This cherry tree, *Prunus padus,* came out with its second production of flowers early in September before the drought had been "broken." A striking additional peculiarity of the serotinal flowers of this species was seen in the presence of many abnormalities or malformations. Phyllody of various flower parts was especially common. Many of the racemes were in fact

transformed into veritable museums of teratological specimens.

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THE UNIVERSITY OF NEBRASKA,
October 10, 1913

AN ANCESTRAL LIZARD FROM THE PERMIAN OF TEXAS

THERE has been no more vexed problem in vertebrate paleontology than the origin of the scaled reptiles. The theory generally accepted has been that the lizards arose from the double-arched or rhynchocephalian type by the loss of a primitive lower arch, a theory of which I have been skeptical for many years past. I have urged in various publications for the past ten years that the lizard phylum is a very ancient one, predicting that it would eventually be discovered in the Permian, a prediction that I am now able to verify. Three years ago I described briefly a peculiar reptile from the Lower Permian of Texas under the name *Arœoscelis*. It has only been recently that the stress of other material has permitted the full preparation of the several more or less complete skeletons upon which the genus was based, a study of which has disclosed more decisively than in any other American Permian reptile the structure of both skull and skeleton. *Arœoscelis* was an extraordinarily slender, long legged, cursorial and arboreal reptile of about eighteen inches in length. The skull is remarkably lizard-like in appearance and structure, with a typical upper temporal vacuity bounded precisely as in the mosasaurs. The sides of the skull below the arch, instead of being open, as in the lizards, are covered over by a broad expansion of the squamosal bone, which is rather loosely united to the quadrate. The quadrate is supported, as in lizards, by the tabulare and opisthotic; it is rather free and is broadly visible from behind. The lacrimal bone is small, as in lizards, a character hitherto unknown among ancient reptiles; and the palate has rows of teeth on all the different bones. The neck has seven or eight more or less elongated vertebræ, the dorsal region twenty. The sacrum is almost indistinguishable from that of lizards. The pectoral and pelvic girdles differ chiefly in their old-fashioned characters. The tail was slender and long. The feet have an elongated calcaneum and a reduced astragalus, unlike those of the known contemporary reptiles. Finally the attachment of the ribs, one of the most peculiar characters of the Squamata, is by a dilated head, articulating with both arch and centrum.

To convert *Arœoscelis* into a modern lizard would require the reduction of the squamosal bone from below to a slender bone articulating with the postorbital; the closer fusion of the postorbital with the postfrontal; the greater freedom of the quadrate; the loss of the posterior coracoid bone and a modernizing of the girdles, every one of which characters we are quite sure must have been present in the ancestors of the Squamata.

Arœoscelis can not be placed in any known order of reptiles, unless it be admitted to the Squamata. But, I do not think that the differences from the Squamata will justify its ordinal separation, if we are to classify organisms phylogenetically. I would rather modify the definition of the order Squamata to include the genus as the representative, doubtless with *Kadaliosaurus* also, of a distinct suborder, the *Arœascelidia*. Several years ago I recognized in another Permian vertebrate a primitive salamander, bearing about the same relations to the modern Urodela that *Arœoscelis* does to the modern lizards. The urodelan character of *Lysorophus* has now been generally accepted, and I believe that after I have published the full details of the structure of *Arœoscelis* I shall find concurrence in its phylogenetic association with the Squamata.

I regret much to add that Dr. Broom's inexperience with the American Permian vertebrates has led him into several errors in his recent discussion of the affinities of *Arœoscelis*, based upon the meager details which have been published. Had he heeded Dr. Case's warning I do not think he would have so readily assumed that the skull and skeletal bones which he described as *Ophiodeirus* really belong together. They probably do not, for